REMARKS

Claims 1-9 are pending in this application. By this Amendment, the specification and claims 1-5 are amended and claims 6-9 are added. Reconsideration in view of the above outlined amendments and following remarks is respectfully requested.

The attached Appendix includes marked-up copies of each rewritten paragraph (37 C.F.R. §1.121(b)(1)(iii)) and claim (37 C.F.R. §1.121(c)(1)(ii)).

The Office Action objects to the specification. By this Amendment, the specification is amended responsive to the objection to define "L/S". Applicant respectfully requests that the objection be removed.

The Office Action objects to the drawings. Applicant asserts that the reference numbers "31" and "29" do not designate the same area because, as disclosed in Applicant's specification (page 10, line 27-page 11, line 1), the secondary image forming surface 29 becomes coincident with an imaging surface 31. As such, Applicant designates two areas (i.e., surfaces) with reference numbers 29 and 31. Moreover, Applicant asserts that the irradiation optical system 10 includes the members from the light source 11 to the measuring mark 52. As such, Applicant asserts that reference numeral 10 properly represents these features. Accordingly, Applicant respectfully requests that the objections to the drawings be removed.

The Office Action rejects claims 1 and 2 under 35 U.S.C. §103(a) over Bareket (U.S. Patent No. 6,023,338) in view of Tanaka (U.S. Patent No. 4,668,077), and claims 3-5 under 35 U.S.C. §103(a) over Bareket in view of Tanaka and further in view of Iwanaga et al. (U.S. Patent No. 5,920,398) (Iwanaga). In light of the above outlined amendments, these rejections are respectfully traversed.

In particular, the Office Action admits that Bareket fails to disclose or suggest a field area adjustment mechanism (page 3, line 7 of the Office Action). The Office Action then asserts that Tanaka discloses a field stop for adjusting the illumination area.

However, Applicant asserts that Tanaka fails to disclose or suggest an optical positional deviation detecting apparatus comprising, among other elements, an image field position adjustment mechanism for adjusting, in a plane perpendicular to the optical axis, a position of an image field for capturing the image of the measurement mark by said imaging device, while maintaining a size of the image field fixed, as recited in claim 1.

Specifically, Tanaka teaches a blind (12) acting as a field stop for adjusting the illuminating area of the illuminating light for the mask (col. 3, lines 18-20; Fig. 1) for projecting the pattern of a photomask (Abstract, lines 1-2). Tanaka does not teach a positional deviation detecting apparatus. Furthermore, the blind (12) in Tanaka is further defined as being equivalent to a shutter mechanism (col. 6, lines 20-24) that opens and closes depending on the level of exposure of a wafer. This function is performed, in Applicant's invention, by the field stop position adjustment mechanism (40, Fig. 1), which is only one part of the image field position adjustment mechanism of Applicant's invention. Applicant asserts that Tanaka fails to disclose or suggest a field stop and an imaging position adjustment mechanism for adjusting a position of the imaging device, as disclosed in Applicant's specification (page 5, lines 2-8).

Therefore, Applicant asserts that the image field position adjustment mechanism of Applicant's claim 1 is not in Tanaka's optical apparatus. Applicant further asserts that Tanaka fails to cure the deficiencies of Bareket in disclosing Applicant's features recited in claim 1.

Moreover, Applicant asserts that Tanaka's blind (12) does not adjust the position of the imaging device in accordance with the field stop positional adjustment effected by the

field stop position adjustment mechanism, as recited in claim 2. Accordingly, Tanaka fails to cure the deficiencies of Bareket in disclosing Applicant's features recited in claim 2.

Furthermore, Applicant asserts that Iwanaga teaches a surface position detecting method for detecting a surface position of a surface to be examined (Abstract, lines 1-2). Iwanaga also teaches a focus detection by discarding an amount of deviation that exceeds a predetermined value (Col. 12, lines 12-25). Accordingly, Iwanaga does not disclose or suggest an optical positional deviation detecting apparatus wherein the image field position adjustment mechanism adjusts the image field position on the basis of an asymmetric focus characteristic, as variably recited in claims 3-5.

Accordingly, Applicant respectfully requests that the rejections of claims 1 and its dependent claims under 35 U.S.C. §103(a) be withdrawn.

In view of the foregoing amendments and remarks, Applicant submits that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-9 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicant's undersigned representative at the telephone number set forth below.

Respectfully submitted,

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MAC:SMSdmw

Attachment:
Appendix
Request for Approval of Drawing Corrections
Information Disclosure Statement

Date: April 30, 2003

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Specification:

Page 6, lines 7-20:

It is therefore preferable that the image field area adjustment mechanism adjusts the image field area on the basis of the asymmetric focus characteristic curve of the line and space (L/S) mark pattern image obtained when the L/S mark pattern image is formed within the image field area of the imaging device. Further, it is also preferable that the image field area adjustment mechanism adjusts the image field area so that the asymmetric focus characteristic curve of the L/S mark pattern image obtained when the L/S mark pattern image is formed within the image field area of the imaging device, exhibits a characteristic that is symmetric to the center of the visual field.

Page 10, line 26-page 11, line 13:

The CCD camera (the imaging device) 30 is disposed so that the secondary image forming surface 29 becomes coincident with an imaging surface 31. The CCD camera 30 ~~photographs~~ captures an image of the measuring mark 52. Then, an image signal pbtained by the CCD camera 30 is sent to the image processing device 35, wherein the image signal is processed as will be described later on. As can be known from this arrangement, the measuring mark 52 and the imaging surface 31 have a conjugate positional relationship. Note that the CCD camera 30 is so supported by an imaging position adjustment mechanism 45 as to be movable in the X-Y directions (i.e., movable within a plane extending in the right-and-left directions perpendicular to the sheet surface).

Page 14, line 21-page 15, line 13:

The image processing device 35 processes the image of the L/S mark pattern ~~photographed~~ captured by the CCD camera 30, thereby obtaining an intensity of the image

signal. A profile of the intensity becomes as shown in Fig. 4C. Herein, though the signal intensity decreases in the recessed positions of the linear marks 61-67, a signal intensity difference ΔI in the recessed positions on both right and left sides of every linear mark, is obtained, and these signal intensity differences ΔI of all the linear marks 61-67 are averaged, thereby obtaining a value Q ($Q = 1/7 \times \Sigma (\Delta I/I)$) representing an asymmetry of the L/S mark pattern image. Next, the L/S mark pattern 60 is moved in the Z-direction by moving the stage 50 in the up-and-down direction (the Z-direction), and the value Q is obtained per height position (the position in the Z-direction), thus obtaining a focus characteristic of the value Q. This focus characteristic is expressed by, for instance, QZ curves as shown in Fig. 5.

Page 17, lines 10-18:

The CCD camera ~~photographs~~ captures an image of the measuring mark 52 by use of the visual fields areas exhibiting the characteristics shown in Figs. 6A-6C, and the alignment positional deviation quantity R of the resist mark 54 with respect to the base mark 53, is measured. In this case, it must be inevitable that the measurement error TIS calculated by the formula (1) occurs, and it is difficult to obtain the accurate alignment positional deviation quantity R.

Page 18, line 24-page 19, line 19:

Therefore, the CCD camera 30 ~~photographs~~ captures the image of the measuring mark 52 in this field area, and the alignment positional deviation quantity R of the resist mark 54 with respect to the base mark 53, is measured. Then, an error based on the rotationally asymmetric aberration contained in the alignment positional deviation quantity R_0 and an error based on the rotationally asymmetric aberration contained in the alignment positional deviation quantity R_{180}, are cancelled each other in the calculation by the formula (1), resulting in an extremely small measurement error TIS.

The accurate alignment positional deviation quantity R can be thereby obtained. Thus, there is set such a field area that the error based on the rotationally asymmetric aberration contained in the alignment positional deviation quantity R_0 and the error based on the rotationally asymmetric aberration contained in the alignment positional deviation quantity R_{180}, are cancelled each other in the calculation by the formula (1), whereby the alignment positional deviation quantity can be always precisely measured irrespective of the elements of the measurement mark.

Changes to Claims:

Claims 6-9 are added.

The following is a marked-up version of the amended claims:

1. (Amended) An optical positional deviation detecting apparatus for optically detecting a positional deviation in alignment between a first mark and a second mark of a measurement mark configured by forming the second mark on the first mark, comprising:

an irradiation optical system for irradiating the measurement mark with a beam of irradiation;

an image forming optical system for forming an image of the measurement mark by converging reflected beam from the measurement mark;

an imaging device for ~~photographing~~ capturing the image of the measurement mark, which has been formed by said image forming optical system;

an image processing device for measuring the positional deviation in alignment between the first mark and the second mark by processing an image signal obtained by said imaging device; and

an image field ~~area~~ position adjustment mechanism for adjusting, in a plane perpendicular to the optical axis, a position of an image field for capturing ~~an image field~~

~~area for said imaging device to photograph~~ the image of the measurement mark by said imaging device, while maintaining a size of the image field fixed.

2. (Amended) An optical positional deviation detecting apparatus according to claim 1, wherein said image field ~~area~~ position adjustment mechanism ~~is constructed of~~ comprises a field stop provided on said irradiation optical system, a field stop position adjustment mechanism for adjusting a position of said field stop, in a plane perpendicular to the optical axis, and an imaging device position adjustment mechanism for adjusting a position of said imaging device,

said field stop and an imaging surface of said imaging device are disposed in optically conjugate positions, and

said imaging device position adjustment mechanism adjusts the position of said imaging device in accordance with the field stop positional adjustment effected by said field stop position adjustment mechanism.

3. (Twice Amended) An optical positional deviation detecting apparatus according to claim 1, wherein said image field ~~area~~ position adjustment mechanism adjusts the image field ~~area~~ position on the basis of an asymmetric focus characteristic ~~curve~~ of the ~~L/S~~ line and space mark pattern image obtained when forming the image of the ~~L/S~~ line and space mark pattern within the image field area of said imaging device.

4. (Amended) An optical positional deviation detecting apparatus according to claim 3, wherein said image field ~~area~~ position adjustment mechanism adjusts the image field ~~area~~ position so that the asymmetric focus characteristic ~~curve~~ of the ~~L/S~~ line and space mark pattern image obtained when forming the image of the line and space ~~L/S~~ mark pattern within the image field area of said imaging device, exhibits a characteristic that is symmetric ~~to~~ with respect to the axis which passes through the center of the visual field and which is perpendicular to a direction in which the positional deviation is detected.

5. (Amended) An optical positional deviation detecting apparatus according to claim 2, wherein said image field ~~area~~ position adjustment mechanism adjusts the image field ~~area~~ position on the basis of ~~an~~ the asymmetric focus characteristic curve of the ~~L/S~~ line and space mark ~~pattern~~ image ~~obtained when forming the image of the L/S mark pattern within the image field area of said imaging device~~at the time when the line and space mark image is formed within the image field area of said imaging device.